-continued

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What is claimed is:

1. An electrochemical aptamer-based (E-AB) sensor comprising a structure-switching cross-reactive aptamer and an electrode, the structure-switching cross-reactive aptamer being conjugated to the surface of the electrode, the structure-switching cross-reactive aptamer comprising SEQ ID No: 19.

2. The E-AB sensor according to claim **1**, the electrode being a gold electrode.

3. The E-AB sensor according to claim **1**, the structure-switching cross-reactive aptamer being labeled with a thiol group at 5' end, and methylene blue redox tag at 3'end.

4. The E-AB sensor according to claim **1**, further comprising a backfiller selected from 6-mercapto-1-hexanol (MCH), dithiothreitol (DTT), and combination thereof.

5. The E-AB sensor according to claim **1**, further comprising a sensor buffer comprising Mg^{2+} and/or Na^{+}.

6. The E-AB sensor according to claim **1**, the structure-switching cross-reactive aptamer having SEQ ID NO: 18 or 19.

7. A method for detecting one or more synthetic cathinones in a sample comprising contacting the sample with the E-AB sensor according to claim **1**, and detecting one or more synthetic cathinones in the sample by measuring a current generated upon binding of synthetic cathinones to the E-AB sensor.

8. The method according to claim **7**, the sample being a biological sample or an environmental sample.

9. The method according to claim **7**, the sample being a seized sample.

10. The method according to claim **1**, the biological sample being selected from blood, plasma, urine, tears, sweat, and saliva.

11. The method according to claim **7**, the one or more synthetic cathinones being selected from 3,4-methylenedioxypyrovalerone (MDPV), α-PVP, pyrovalerone, methylone, pentylone, 3,4-methylenedioxy-α-pyrrolidinobutiophenone (MDPBP), mephedrone, 4-methyl-α-pyrrolidinobutiophenone (MPBP), 4'-methyl-α-pyrrolidinohexanophenone (MPHP), naphyrone, methedrone, ethylone, butylone, 4-methylmethcathinone (4-MMC), 4-fluoromethcathinone (4-FMC), 3-FMC, methcathinone, and 4-methyl-α-pyrrolidinobutiophenone (MEPBP).

12. The E-AB sensor according to claim **1**, the structure-switching cross-reactive aptamer being modified with a linker.

13. The E-AB sensor according to claim **12**, the linker having from 1 to 10 carbons.

14. The E-AB sensor according to claim **13**, the linker having 6 or 7 carbons.

15. The E-AB sensor according to claim **1**, the structure-switching cross-reactive aptamer being conjugated to the electrode via a functional group.

16. The E-AB sensor according to claim **15**, the functional group being selected from thiol, amide, ester, alkenyl, alkynyl, carbonyl, aldehyde, carboxylate, carboxyl, and carbonate ester groups.

17. The E-AB sensor according to claim **1**, the electrode being made of gold, silver, or platinum.

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